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## **Annual Report**

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This report summarizes the first year of an anticipated 3-year project to survey for the presence of wolverines on the Targhee National Forest. The project has been conducted under a cooperative agreement between the University of California, the Targhee National Forest, and the Idaho Department of Fish and Game. Funding for the effort is shared among the cooperators, under a Challenge Cost-Share Agreement with the Targhee National Forest, Contract #15-CCS-99-6. Supplemental funding was provided by the David Gaines Memorial Award provided through the Department of Environmental Studies at the University of California, Santa Cruz.

A downloadable pdf copy of this report is available at <http://gis.ucsc.edu/Projects/gulo.htm> or contact the Targhee National Forest Supervisors Office at (208) 624-3151

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## Introduction

During 1998-99, the Targhee National Forest, Idaho Department of Fish and Game and the University of California, Santa Cruz entered into a collaborative agreement to begin an anticipated 3-year project to conduct research on the distribution of wolverine across the Targhee National Forest. Additionally, we agreed to examine the potential impacts to wolverine due to backcountry winter recreation on the Forest, particularly snowmobile and ski recreational uses. This report summarized the results of the first year (1998-99) of the project. Over the course of 1998-99, we produced maps showing the potential denning habitats available to wolverine across the Forest and the adjacent Grand Teton National Park. We also conducted aerial surveys of portions of these habitats to search for the presence of wolverine as indicated by their tracks in the snow and to document evidence of snowmobile and ski use associated with these habitats. We developed GIS coverages of our results, to allow analyses of the data in a spatially-explicit manner and to create maps that may prove useful for management decisions.

## State of Knowledge

Wolverine (*Gulo gulo*) are rare, medium-sized carnivores that historically inhabited forested regions across the northern tier of North America. Their distribution included much of Canada, southward into United States from Maine to Washington state. Southward, wolverine extended down the Cascade Mountains of Oregon and into the southern Sierras in California, and down the Rocky Mountains into Arizona and New Mexico (Grinnell et al. 1937, Banci 1994, Hash 1987). The wolverine has experienced dramatic reductions in their southern distributional extent. In the United States, their present distribution is restricted to the Rocky Mountains, and only Idaho and Montana are known to support populations. The wolverine is considered extirpated or at extremely low numbers in the Pacific States and the southern Rocky Mountains. Even in Idaho and Montana, we know very little about the extent and status of wolverine populations.

Low population densities, large spatial requirements and a preference for remote subalpine habitats have resulted in very few studies of the ecology and life requisites of this rare carnivore. To date, there have only been 6 studies of wolverine in North America, and only 2 in the United States (Copeland 1996, Hornocker and Hash 1981). The reductions in their occupied range and our inability to effectively gather adequate information on their distribution and population viability are causing increasing concern over their present status. The Forest Service and the Bureau of Land Management list the species as Sensitive, and the US Fish and Wildlife Service list the wolverine as a C2 species. It is considered a Species of Special Concern or Protected in Idaho, Wyoming and Utah. In Colorado, the wolverine is listed as Endangered at the state level, and California and Oregon list it as Threatened. It is considered a furbearer in Washington, with a closed season. Montana and Alaska are the only states to maintain trapping seasons on the species. In Montana, a limited harvest is allowed, and is primarily maintained to allow for the incidental take of wolverines in traps set for other target species.

We have little understanding of the historical and current impacts to wolverine populations. Some historical threats may continue to threaten wolverine populations, including habitat alteration and population isolation. Additionally, new threats place novel stresses on the remaining populations. One relatively new potential impact is winter recreational use of natal denning habitats. Female wolverines appear to prefer high elevation, north-facing talus slopes for natal denning. Often located within cirque basins, the females occupy extensive snow tunnels that form a complex of dens (Magoun and Copeland 1998). These dens are occupied during the early spring (February – April) birthing and whelping periods. There is a growing body of evidence that females are prone to disturbance at den sites, particularly at the natal dens where birthing occurs. Idaho wolverine selected specific natal and kit rearing habitat and responded negatively to human disturbance near these sites (Copeland 1996). Female wolverine abandoned dens in Finland (Pulliainen 1968) and Norway (Myrberget 1968) when disturbed by human activity.

Both snowmobile use and backcountry ski use has seen rapid increases in popularity over the last several years. Advancements in the power and technology of snowmobiles has resulted in machines and riders that can readily access what was previously viewed as inaccessible areas due to the rugged terrain. These remote areas are favored by extreme snowmobilers, who use the steep slopes of the cirque basins as playgrounds. Unfortunately, it is during the wolverine denning season (February – April) that we may see the highest or most intense recreational use of denning habitats (i.e., cirque basins), by both snowmobilers and skiers. Spring snow pack provides the most favorable conditions to access the remote regions. Unfortunately, it is exactly during this time when these recreationists will most negatively affect reproductive activities of resident wolverines. As snowmobiling and backcountry skiing continues to grow in popularity, there is an increasing concern that reproductive habitats may become limiting to populations due to human disturbance. Protection of reproductive denning habitat may be critical for the persistence of wolverine. A clear association between wolverine presence and refugia (e.g., Wilderness Areas) may be strongly linked to a lack of available reproductive denning habitat outside protected areas.

In addition to a lack of basic ecological information, we also currently have only a limited suite of techniques to even identify the presence of wolverines in a region (Zielinski and Kucera 1995). There is a pressing need to develop techniques that are both effective and financially feasible for documenting the presence and distribution of wolverines. Over the past 10 years, there have been attempts to survey for wolverine through the use of snowtrack surveys and camera stations, with some success. Though wolverine are readily distinguished by their track, and have been documented at several camera stations, these techniques are limited in their utility because wolverine are likely found primarily in unroaded areas. Unfortunately, both these techniques require access by snowmobile to be truly effective and efficient as survey tools. Therefore, while successful detection of wolverines via these techniques provides valuable information, the lack of detection provides limited information because the surveys are conducted in habitats that may or may not be used by the species, even if it is present in the region. Though there

have been attempts to conduct both these survey techniques across unroaded regions, the longterm utility of these efforts is limited due to the extreme logistical requirements of such efforts.

### **Development of habitat model and aerial survey technique**

Recent data on wolverine behavior and habitat use in Idaho (Copeland 1996) suggest that winter aerial surveys may provide an alternative to ground methods. Female wolverine in Idaho located reproductive dens in cirque basin areas that lacked overstory canopy allowing snow trails of females traveling to and from natal and maternal dens to be visible from aircraft. High elevation ridges were also used as travel-ways by dispersing male wolverine during winter months. Properly timed over-flights of subalpine habitats may reveal presence of denning female wolverine or associated resident or dispersing individuals.

In 1996, the Idaho Department of Fish and Game and the Montana Spatial Analysis Lab entered into a cooperative effort to investigate the feasibility of modeling wolverine habitat (Hart et al. 1997). Physiographic characteristics associated with Idaho den sites were used to construct a GIS model which predicted habitat suitability. When applied to a geographic region, the model identifies sites where habitat conditions may be suitable for denning, and thus potentially occupied by a wolverine.

The denning habitat model was first presented at the Western Forest Carnivore Committee meeting in Spokane Washington in 1996. Since that time, some wildlife agencies (Idaho, Colorado, Washington) have applied the model to predict potential wolverine denning habitats, and also as a tool to guide aerial surveys. Edelmann and Copeland (1999) applied the denning model in the Seven Devils of western Idaho, providing the first confirmed evidence of wolverine presence in that region. To date, the combined use of the denning model and the aerial surveys for wolverines provides promise of a potentially powerful tool for identifying the presence of wolverine. The advancement of this technique requires that we develop protocols that provide effective survey sampling techniques that can be applied across large and diverse landscapes. In the absence of sound protocols, the precision, and applicability of survey results cannot be evaluated. Additionally, a probability-based survey-sampling approach is desirable when the area to be searched is too large for direct censusing.

The validity of survey estimates will only be known with the development of a sound sampling protocol incorporating wolverine natural history. Combining the ability to predict denning habitat and the high detectability of denning female wolverine, with a sound and validated survey-sampling protocol (suitable for applying over large geographical areas) may provide a means for scientifically determining and tracking the distribution of reproducing populations of wolverine in the western United States.

## **Methods**

### **Habitat Model**

We used the GIS-based model developed by Hart et al. (1997) to predict potential wolverine denning habitats across the TNF. The original version of the model selected habitats with the following characteristics, designed specifically to identify high elevation cirque basins:

1. north and east slopes (320 degrees to 130 degrees)
2. elevations above 8000 ft (2631 m)
3. concave and flat slopes
4. rock and ice cover types
5. patch sizes at least 10 ac (4 ha)

We modified this model slightly by adding areas of alpine herbaceous habitats to existing rock/ice habitats. Additionally, we used 6 ha as the lower polygon size, in an attempt to eliminate polygons of such small size as to likely not represent areas of high potential use. We used a Thematic Mapper classified land cover coverage (acquired via Utah State University) at a resolution of 1:100,000, and USGS Digital Elevation Models at 1:24,000 scale. We used Arc/Info GRID to perform the queries that resulted in the selection of habitats meeting the model criteria.

After examining the results of the model, we defined sampling units for our survey effort. This was primarily done to allow us to organize the survey effort and to provide us with a unit of analyses for examining the results. The predicted habitat coverage was draped over a shaded relief map of the study area for map production. Along with roads, the shaded relief map facilitated easy navigation to the sites from the air. Plots of each sampling unit were produced, and these became our primary field maps for the survey effort.

### **Aerial Surveys**

We used the denning habitat model to focus our aerial survey effort in habitats in which we may have a high potential to detect wolverine, if they are present. As such, we were not surveying for denning females, per se, but any evidence of wolverine presence. We conducted the surveys from helicopter in mid-March, 1999. The timing of the surveys was planned to coincide with the peak reproductive period, maximizing our probability of finding wolverine sign in the high elevation habitats identified in our GIS habitat model. Helicopter availability and weather limited the days during which surveys could be conducted.

Surveys were conducted at low elevations (under 500ft AGL), and the flight paths were recorded using a Global Positioning System (GPS; Trimble GeoExplorer II). We



navigated to potential habitats using maps, and circled each area once or more as we visually searched for tracks and other signs of wildlife activity. We attempted to survey all habitats identified by the habitat model one time over the sampling period. If potential wolverine tracks were sighted, we hovered, circled, or landed the helicopter to determine the species identification of the sighted track. The location of wolverine tracks was recorded by the GPS, and photos were taken of the tracks. We documented evidence of snowmobile and ski use (i.e., tracks in the snow) over all the areas we flew, using both the maps and the GPS to record these observations.

The GPS data recording the flight path, recreational use and wolverine locations was post-corrected using the Idaho National Engineering and Environmental Laboratory (INEEL) base station located in Idaho Fall, ID. The corrected data was exported as a shape file, and brought into ArcView for viewing and analyses. In some instances, we converted the shape files to ArcInfo coverages. We created a coverage of our flight lines, and of the wolverine sightings. Additionally, through digitizing and the use of the GPS data, we created coverages of snowmobile and ski use documented during our flights.

We used our GPS flight line to assess our survey efficiency within each sampling unit. We buffered the survey flight line by 300 m as an estimate of our average visual distance, and overlaid this onto the predicted habitats. All polygons of predicted habitats that overlapped with the buffered flight line were considered to have been searched during the survey. Habitats that did not overlap the buffered flight line were considered not surveyed. To assess the amount of wolverine habitat that contained recreational use, we selected only those habitats for which surveys were conducted, and overlaid those habitats with the coverages of snowmobile use and ski use. We calculated the percentage of the surveyed habitat polygons that contained recreational use (either snowmobile or ski use) in at least part of its extent. We did these analyses on each of the 5 sampling units.

## **Results**

In this section, we describe the results of this first year of the wolverine survey effort. These results are necessarily preliminary, as the survey effort and development will continue for 2 more years. Still, given the current lack of information regarding wolverine distribution and status on the Forest, we believe it may be useful to provide preliminary results from the project to date.

### **Habitat Model**

The GIS model predicted 4,470 ha of wolverine denning habitat across the Forest, and an additional 3,364 ha of denning habitat in areas that were adjacent to the Forest. By far, most of this adjacent habitat occurred in the Grand Teton National Park (GTNP), with nearly 3,000 ha of predicted denning habitat in the Park. The predicted habitat occurs across the landscape in 5 patches, which we post-hoc designated as sampling units

(Figure 1). Figure 2 shows the distribution of the predicted habitat within each of the 5 Sampling Units (SUs), and Table 1 lists the amount of predicted denning habitat in each unit.

## Aerial Surveys

*Survey Effort.* During mid-March, we attempted to survey on 4 days. On 15 March, we were forced to abandon the flight due to strong winds at high elevations after reaching the Palisades SU. We surveyed for 8.5 hours on 18 March, 2 hours on 19 March and 0.5 hours on 24 March. With a total of 11 hours of survey time (a total of 16 hours of flight time, including shuttle time from Idaho Falls to the sampling units), we completed the surveys of the Palisades, Teton, Island Park, and East Dubois SUs, and the southern portion of the West Dubois SU. We were unable to complete the northern portion of the West Dubois SU due to poor weather, declining snow conditions, and budgetary constraints.

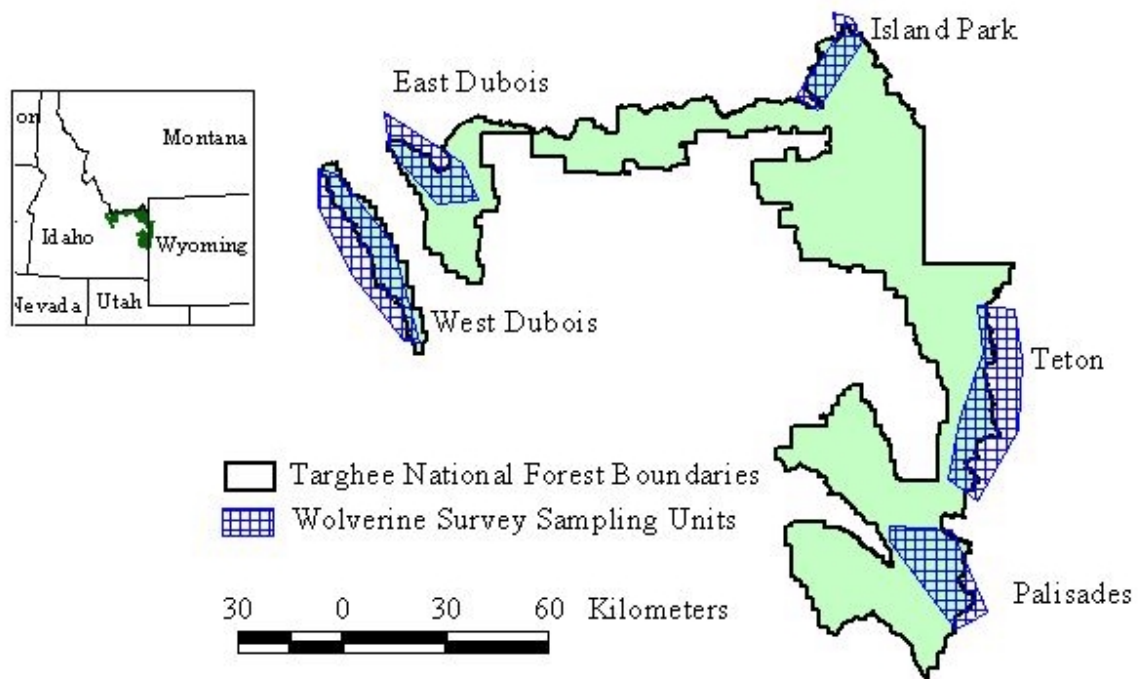


Figure 1. Potential denning habitats for wolverine were predicted to occupy 5 regions of the Targhee National Forest in eastern Idaho and western Wyoming. These areas formed natural sampling units for the aerial survey effort.

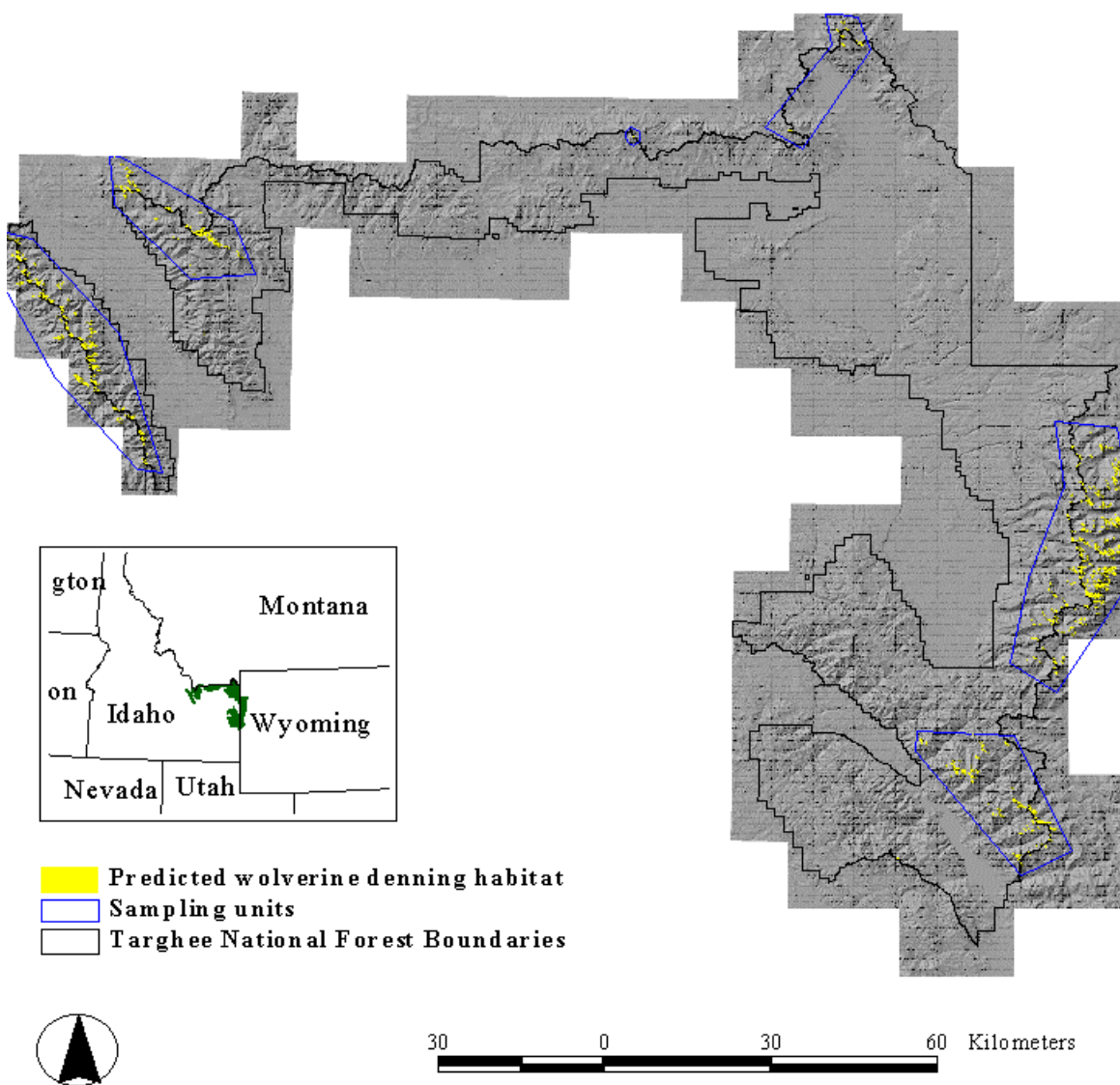


Figure 2. Predicted distribution of potential wolverine denning habitats on the Targhee National Forest and adjacent lands.

Table 1. Area of predicted wolverine denning habitat in each of the 5 sampling units across the Forest, and in the Grand Teton National Park.

Sampling Unit	Area of Predicted Wolverine Habitat (ha)
West Dubois	1,951
East Dubois	813
Island Park	164
Teton (TNF lands only)	457
Palisades	1,085
Grand Teton National Park	2,990

As stated earlier, we attempted to survey all of the predicted habitats located on the Targhee National Forest in each of the Sampling Units. The exception to this is the West Dubois SU, for which we did not attempt to survey the northern portion of the area. Figure 3 shows our flight paths within each of the sampling units, as documented by GPS. Of the habitats we *attempted* survey, we successfully searched 67%. The success rate varied across the Forest, from 91% surveyed in the Island Park SU, to 58% in the East Dubois SU (Table 2).

*Gulo Locations.* We located 4 sets of wolverine tracks, all of which were associated with foraging digs (Figure 3). Two of these tracks were found in the Teton SU: one pair on the back side of Grand Targhee Ski Resort (Fred's Mountain), and another set of tracks was found approximately midslope on Treasure Mountain. In the Island Park sampling unit, we located wolverine tracks in a tributary of West Targhee Creek. A set of wolverine tracks was also located in the East Dubois sampling unit in the basin at the headwaters of Eighteen Mile Creek. Though the original sighting of the tracks was on the Montana side of the Centennials, the tracks crossed the ridge and entered Montana Canyon on the TNF. We did not find sign of wolverine in either the southern portion of the West Dubois SU or the Palisades SU.

The Island Park location was likely a reproductive den, as evidenced by the extensive amount of longterm use of the area and den complex. We located this den complex on 18 March, but were unable to land due to the weather conditions. On 19 March we returned by helicopter and examined the area on foot. There was a complex of

Table 2. For each sampling unit, the percent of the habitats we attempted to survey that we actually did survey.

Sampling Unit	Percent of attempted habitats successfully surveyed
West Dubois	72
East Dubois	58
Island Park	91
Teton	59
Palisades	73
All Sample Units Combined	67 +/- 13.5

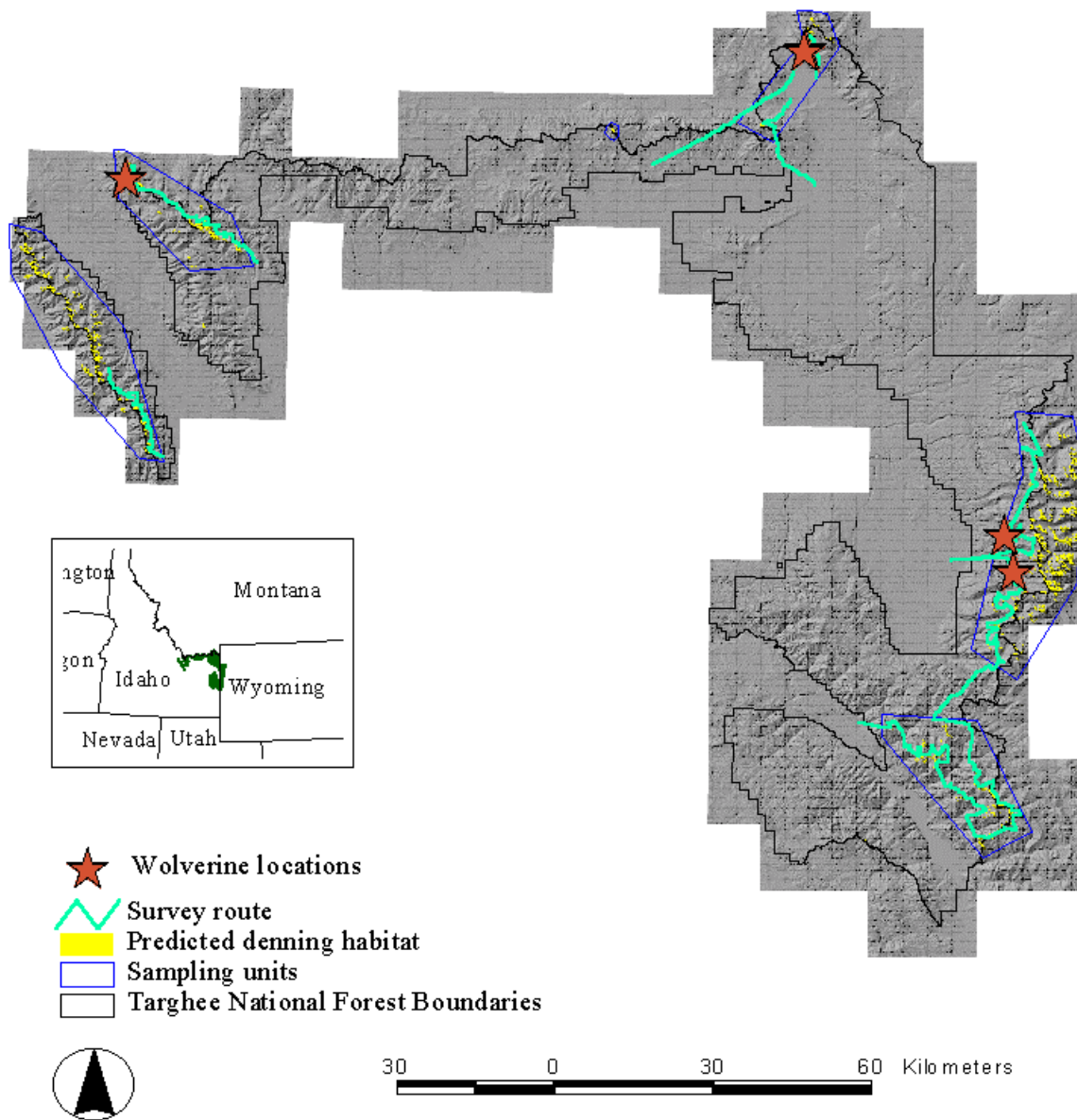


Figure 3. Aerial surveys of predicted wolverine denning habitat. Routes were documented using a Global Positioning System. Stars indicate where we found tracks of wolverine, indicating presence of the species in the area.

at least 3 dens in the area, with a one den having a high probability of housing kits, while another sites appeared to be a potential foraging locations. We remained only briefly in the area (less than 1 hour), to document the tracks and photograph the site. We returned to the area in early August to examine the site after snowmelt. The reproductive den was created by a fallen log immediately adjacent to forest cover, but located along the base of a talus slope forming the southern edge of the drainage. The open talus slope and associated cliff forming the north-facing drainage wall were approximately 300 m wide, and continued for several hundred meters along the base of the slope. Both the log and the air spaces in the talus likely formed the den complex. The other sites were located higher up on the talus slope, and were formed by large boulders. There was a large amount of deer hair associated with the site closest to the reproductive den (within 50 m).

*Recreational Use.* The extent and intensity of recreation use varied across the Forest. Though we did not make any attempt to quantify the intensity of use, some differences were apparent, and are mentioned here. The results of overlaying the documented snowmobile use with the predicted wolverine denning habitats showed that overall, 33% of the wolverine denning habitat that we surveyed had evidence of recent snowmobile use. The use varied across the study area (Table 3), from 100% of the surveyed predicted habitats showing heavy use in the Island Park SU to no documented use in the West and East Dubois SUs. Island Park showed not only the most extensive use, but also the most apparently intensive use, with heavy snowmobile traffic throughout the surveyed area, and most open slopes and basins being used as play areas. There was also notable widespread snowmobile use in the Palisades, with 59% of the surveyed habitats showing evidence of moderate to high recent snowmobile use. The Teton area showed a moderate amount of use (22% of habitats with evidence of snowmobile use). The snowmobile use in the Teton areas appeared of a lower intensity than found in either Palisades and Island Park, and consisted primarily of travel routes.

In general, there was less evidence of backcountry ski use in the surveyed potential denning habitats, with 18% of the surveyed habitats showing recent use by skiers. Ski use of areas that were potential wolverine denning habitats was limited to the Palisades and Teton SUs during our surveys. The Teton SU showed the most widespread ski use, with 47% of the predicted habitats showing evidence of recent skiers. The use appeared primarily to being single travel tracks, with few play areas noted. It is

Table 3. Percent of surveyed potential habitats that had snowmobile use.

Sampling Unit	Percent of Surveyed Potential Habitats with Snowmobile Use
West Dubois	0%
East Dubois	0
Island Park	100
Tetons	22
Palisades	59
Across the Forest	33

Table 4. Percent of surveyed potential habitats that had snowmobile use.

Sampling Unit	Percent of Surveyed Potential Habitats with Ski Use
West Dubois	0
East Dubois	0
Island Park	0
Teton	47
Palisades	26
Across Entire Forest	18

possible that the skiers were heading towards the more remote basins and bowls of the GTNP, which were not surveyed and could be receiving more intensive ski use within potential denning habitats. The Palisades SU showed limited, but more intensive ski use. This use was associated with a heli-skiing operation that places the skiers with a complex of basins that are characteristic denning habitats. This heli-skiing operation resulted in 26% of the predicted denning habitats in the Palisades SU showing signs of recent ski use. Though we noted ski use in the Island Park SU, we did not see evidence within potential denning habitats. We did not see any evidence of backcountry ski use in the West and East Dubois sampling units where we conducted surveys.

## Discussion and Future Activities

It is preliminary to make recommendations after only a single season of data collection on an anticipated 3-year project. Based on this initial year, it is most appropriate to discuss improvements and future objectives of the project itself. Below, we discuss the habitat model and the survey effort, in light of potential modifications and anticipated developments for the upcoming year. We then briefly review what we have learned about the distribution of recreational uses across the Forest, in light of potential impacts to wolverine.

### Habitat Model

The GIS model we used to predict potential habitats is based on characteristics of known denning sites for reproductive female wolverine in the US Rockies (Copeland 1996, Magoun and Copeland 1998). We believe this model may guide our survey efforts to those regions of the landscape where we have the highest potential of locating wolverine tracks, if there are wolverine in the region. This is partly because reproductive females may be focusing their activity in these habitats during the survey period, but also because both male and female wolverine tend to spend significant amounts of time in these habitats. Additionally, these habitats are open, treeless sites that allow for relatively

easy aerial surveys. This initial year has provided us with positive results for the utility of the denning model as a tool to focus our aerial survey effort. The model brought us to areas in which we successfully identified the locations of 4 wolverine. Importantly, it identified 2 of these animals in the Teton area, where there are at least 3 animals, based on a concurrent radio-telemetry project. We will continue to take advantage of these radio-instrumented animals to test and refine both our habitat model and the survey sampling protocols in the upcoming year. Additionally, we located two animals in areas where, though we may have suspected wolverine, we had little current information on their presence.

Interestingly, the Island Park location was not in predicted habitat, though the characteristics of the site fit the criteria that the model is based on. The problem lies in the scale of the underlying data used to build the model. The vegetation layer is interpreted satellite TM imagery, with a resolution of 1:100,000. While this data represents the most current and readily available source of imagery we have for the region, its coarse scale results in the averaging over of small pockets of habitat, such as where we found the Island Park den complex. Though there are no easy solutions to data accuracy and resolution problems, we will explore other sources of vegetation and land cover data that may complement the satellite imagery, while still maintaining consistent results and manageable data storage and manipulation.

## **Aerial Surveys**

Improvements in the efficiency of the survey effort are being pursued through examination of potential sampling designs. Because it is ineffective (and impossible) to examine every potential complex of predicted habitats across the landscape, it will be necessary to develop a sampling protocol before the survey technique can be applied across extensive regions. During this initial year, we attempted to survey 100% of the predicted habitats. On average, we successfully reached 66% of the habitats we sought to cover. These results provide us with an estimate of survey efficiency, which can then be incorporated into sampling designs. The success rate across the sampling units was variable, primarily due to weather and wind conditions, but also the varying spatial distribution of the habitats. Overall, wind conditions were a primary factor limiting our attempts to enter the cirque basins areas where the majority of the habitat is found, and this was particularly true for the East Dubois area. Additionally, the spatial arrangement of the habitats across the landscape may limit the feasibility of searching patches that are isolated or disjunct from the primary flight path. For example, the Island Park SU contains a large cluster of habitats in the northeastern portion of the study area, with just 2 small patches of habitat along the Centennial Mountains. Our decision was to forego the expense of traveling to the most isolated of these patches, in favor of focusing our resources in areas with higher amounts of habitat.

Other factors that influence the survey effort include the lighting conditions. It is necessary to have clear, sunny days for the best lighting to observe tracks on the snow surface. Additionally, it is necessary to survey when the potential habitats are in the



sunlight, as tracks are difficult to sight when the habitats are shaded. Because many of the predicted habitats are in basins, the hours per day where the lighting is optimal (i.e., the basin is not in the shade) is limited, and therefore limits the numbers of hours and timing of the surveys.

Snow conditions can have an obvious influence on the survey effort. While the high elevation, north and east facing slopes predicted in the habitat model are less likely than other habitats to form hard crusts, this can be a concern. Ideally, surveys would be timed to occur within a week of snowfall. It is recommended that at least 2 nights be allowed to pass before surveys are done following a track-clearing snowfall (i.e., > 2 inches), to increase the number of potential tracks that could be sighted. Additionally, high winds in the open habitats can quickly fill in tracks with blowing snow. Tracking conditions will vary widely from region to region, and the probability of crust formation and blowing snow in the predicted habitats should be assessed by someone knowledgeable of snow conditions in the region.

### **Potential Recreational Impacts**

It is preliminary to draw conclusions on potential impacts to wolverine based on a single survey effort. Yet, given the possible sensitivity of wolverine to disturbance during the denning period, it would be negligent to ignore even small amounts of information on the current extent of the recreational use across the Forest. Prior to our surveys, there was limited knowledge of the recreational use in some areas of the Forest. Our surveys indicate that snowmobile use, in particular, is much more widespread than previously thought. Notable numbers of snowmobile recreationists are using regions of the Forest previously thought inaccessible due to their remoteness and ruggedness. This is particularly true in the Palisades and Island Park Districts, where we documented heavy and widespread use of habitats that are quite remote and extremely rugged. The increasing power of snowmobiles, as well as their increasing popularity, has likely resulted in the expansion of snowmobile activity into previously undisturbed areas. As previously discussed, it is during the wolverine denning season (February – April) that we may see the highest or most intense use of cirque basins as snowmobile playgrounds.

Ski use within potential wolverine denning habitats was found on the Teton and Palisades Districts. As stated earlier, most use in the Teton SU were single, linear tracks of skiers traveling deeper into the Tetons. We do not know the impacts that such limited activity may have on a denning female. It is possible that females will avoid potential denning habitats that receive chronic ski traffic. We found the highest ski activity in potential wolverine habitats in the Palisades SU. This use was confined to a limited area around the heli-skiing operation. Ski activity may have the potential to discourage the use of the impacted habitats by a reproductive female. In combination with the widespread snowmobile use in the Palisades area, there may be significant recreational impacts to wolverine denning habitats in this area. We did not see any ski use within predicted habitats on the Island Park SU, though we documented use on lower ridges and slopes. Our assessment of ski extent in the Island Park SU may be biased because of the

high snowmobile use, which likely destroyed any signs of ski use and may have discouraged skiers from using the high basin areas.

We do not know the buffer needed between disturbance and a denning female to avoid displacing the animal. While the West Targhee Creek Basin that housed the probable den site was completely free of snowmachine activity, snowmachine use bordering the basin was intensive and completely surrounded the site. As we continue to monitor the site in the future, this may provide some insight into the level and proximity of disturbance that female wolverine may tolerate during the denning period.

It will be necessary to conduct further investigations into the patterns of winter recreational use across the Forest, and their potential impacts on wolverine prior to making recommendations to minimize these potential impacts. We will continue to document recreation use within wolverine habitats, and will work with Forest biologists and managers to gather the types of data that will be most useful for the management of the recreational use of these habitats.

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